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Estimating cannibalizing effects of sales promotions: The impact of price cuts and store type

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ABSTRACT

To evaluate the financial impact of supermarket sales promotions, managers must estimate how much new demand comes from cannibalizing the base product compared with other sources. However, investigations into cannibalization are scant. Using vector autoregression analytical framework applied to three years of supermarket scanner data, and sales promotions for pound cake, we estimate cannibalization effects for two common price reductions (10% and 15%), across large, medium and small supermarkets. The sales bumps varied across supermarkets for each price cut while cannibalization effects were substantial only in large supermarkets, with moderate effects in medium stores and no effects in small supermarkets.

1. Introduction

Packaged goods manufacturers spend a significant proportion of their marketing budgets on sales promotions, even more than the combined expenditure on television and radio advertising (Zenith Optimedia, 2017). Few other marketing instruments are considered to be as effective in stimulating immediate and substantial sales increases (Bijmolt et al., 2005; Blattberg et al., 1995). Product and brand managers regularly negotiate sales promotion schedules with retailers to employ various sales promotion tools such as temporary price cuts, catalogues, coupons, rebates, in-store advertising and displays, free samples, and competitions (Silva-Risso et al., 1999).

Sales bump effects arising from a sales promotion are generally explained by three customer activities — *purchase acceleration* (customer maintains regular consumption but stockpiles for later use); *increasing quantity* (customer increases consumption due to the promotion) and *switching behavior* (Gupta, 1988). Switching may involve a customer substituting one product for another, for example from soft drink to bottled water (category switching), changing brands within a category, such as from Coke to Pepsi (brand switching), shopping at a different supermarket to take advantage of the promotion (store switching) and finally, customers switching to another SKU of the same brand, in the same store at the same time. In this case, the customer takes adavantage of the sales promotion which might be a '10% temporary price cut', '10% more at the regular price', or 'buy one get one free', which results in cannibalization of the manufacturer's margins (Van Heerde et al., 2004). For any sales promotion, brand managers are particularly interested in whether the promotion creates incremental transactions or simply provides discounts to existing customers who would have paid full price (Norvell and Horky, 2017).

As supermarket grocery purchases comprise low-involvement decisions, it is reasonable to expect that the majority of new demand following a promotion can be attributed to existing loyal customers. However, the ability to estimate cannibalization effects is complicated given industry practice of substituting the regular product with the promotion, a situation that explains why few emprical studies have addressed this topic in a grocery shopping context (Van Heerde et al., 2004). In France however, supermarkets operate within a different system whereby the regular product remains in the store at full price at the same time as the sales promotion. For example, the regular product may be complemented by an offer of 'buy one get one free' which is situated in display bins at the end of the aisle. This allows a customer to choose either the promotion or the regular, non-promoted version of the identical product. In these circumstances, the non-promoted product retains its regular SKU barcode and shelf location, while the promotion displayed nearby receives a different SKU to ensure that the promotion price is correctly charged at the checkout. Having both versions of the same product available to customers simultaenously provides a unique opportunity to study how much of the non-promoted product's sales are cannibalized by the promotion.

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To address this knowledge gap and assist managers in fully evaluating the financial success of sales promotions, the current study investigates cannibalization on a frequently purchased grocery item (packaged 'quatre-quarts' cakes similar to pound cake in the USA) for two common temporary price cuts (10% and 15%), across different supermarket sizes — large, medium and small. A photograph of quatre-quarts cake apperas in Appendix 1. Drawing on three years of supermarket scanner data and a manufacturer's sales promotion schedules for the same period we employ vector autoregression (VAR) analytical framework to calculate sales bumps arising from temporary price cuts and estimate cannibalization on the non-promoted brand. We begin the remainder of the paper with a review of the relevant literature covering cannibalization theory and its application to sales promotions, which leads to our research objectives. Next, we outline the current study and present the findings. Finally we conclude by addressing theoretical and managerial implications.

1.1. Literature review and research goals

In this section we review the extant literature addressing cannibalization and describe key empirical research investigating sales bump effects, together with studies decomposing sources of new demand arising from sales promotions. We conclude this review by considering customer behavior theories which provide a base for explaining our findings.

1.2. Cannibalization

In marketing, cannibalization is defined as a reduction in sales volume, sales revenue, or market share of one product as a result of the introduction of a new product by the same producer (Kotler and Keller, 2012). Its theoretical roots have been traced to cross-elasticity of demand theory (Kerin et al., 1978). Two forms of new products with potential to cause cannibalization effects are distinguished in the literature: brand extensions and line extensions. Given its importance in product and brand portfolio management, a large body of research has studied cannibalization resulting from these marketing actions (Lomax and McWilliam, 2001). This research falls into three broad groups — potential causes of cannibalization (Kim and Chhajed, 2000), scope of effects (González-Benito, 2010), and investigations within specific contexts (Gallagher, 2014; Jayarajan et al., 2018; Sharma et al., 2018). Despite these valuable empirical contributions, our knowledge of cannibalization remains incomplete as this research considers the effects of brand and line extensions which are relatively lasting, where customers have time to consider the potential benefits of the new offering compared with the original. However, where the new product is offered for only a limited time as with a sales promotion, research remains scant.

In what appears to be the only prior study measuring cannibalization effects resulting from a short term sales promotion, Van Heerde et al. (2004) compared sales in stores offering a price promotion with those without the promotion. In their study, findings for peanut butter showed cross-brand effects of 43%, cross-period effects 24% and category expansion (market expansion and cross-store effects) of 33%. In splitting cross-brand effects between within-brand (cannibalization) and between-brand (brand switching) effects, they conclude that 79% of the within-brand effect is explained by cannibalization (ie about 39% of total new demand). These findings are insightful as they provide an initial estimate of cannibalization effects. However, their study has some limitations that suggest that further investigation is warranted. By combining all price cuts of 5% or higher into one category, the study did not attempt to measure effects of specific discounts. Furthermore, the study was conducted in one supermarket chain (store type). Consequently, unanswered questions remain about whether these findings may be generalized to other product categories, for different levels of price cuts or across a broader range of supermarket types.

1.3. Sales bump effects

A significant body of research has investigated the sales bump effects arising from a sales promotion. Summarizing early research, Chevalier (1975) noted that, in addition to being significant and immediate, the sales bump can vary across brands and stores. These findings have been supported in many studies since (Bell et al., 2011; Blattberg et al., 1995; Neslin, 2002). For example, Bell et al. (2011) demonstrate that the average impact of sales promotions in hypermarkets can be between 2.1 to 4 times regular sales depending on the promotion and product. Regarding effects of temporary price cuts, Bijmolt et al. (2005) report that the average short-term price reduction elasticity is -3.63, whereby a 20% temporary price reduction leads to a 73% rise in sales based on a meta-analysis of 1851 price elasticities from 81 studies. Researchers have also examined how price reductions, features and displays impact promotion outcomes. Both features and displays show a positive effect on sales over and above the effect of a simple price reduction (Narasimhan et al., 1996), whereas negative interactions have been demonstrated when price reductions are integrated with features or displays (Gupta, 1988).

1.4. Decomposing the sales promotion bump

Decomposing the sales bump arising from a sales promotion in critical. Although new demand may be considerable, financial implications for the manufacturer depend on the growths' sources. For example, cross-brand effects and category expansion are positive outcomes for a brand, while purchase acceleration through consumer stockpiling may provide only short-term benefits. Furthermore, when a brand is offered at a price reduction, cannibalization has negative financial consequences as the new offer reduces the manufacturer's unit contribution margin, although profits may be higher due to increased overall sales. Underpinning its importance for managers, researchers now agree that cannibalization dominates sales bump effects. Although this view is intuitively appealing given the low-involvement nature of grocery purchases, early research argued the opposite, that brand-switching effects dominate. However, in disputing these findings, Van Heerde et al. (2003) estimate that around two-thirds of incremental sales of a brand is due to primary demand (new and current consumption, plus stockpiling) with only one third attributed to secondary demand (brand switching). Other studies since have largely supported these findings (Chan et al., 2008; Pauwels et al., 2002). Conversely, cross-category effects are estimated by Van Heerde et al. (2004) to represent only 6% of new demand in their study of tuna, prompting Leeflang et al. (2008) to suggest that researchers and managers focus their attention on within-category effects.

1.5. Cross-brand (brand switching) effects

Brand switching following a sales promotion, has been shown to vary across different product categories. For example, in one study an increase of only 8% was reported for orange juice (Nair et al., 2005), compared with a high of 56% for ketchup (Sun et al., 2003), while studies of other products —soup (11%), yogurt (39%) (Pauwels et al., 2002), sugar (45%), yogurt (33%), and tuna (33%) (Van Heede et al., 2003) — fall within this range. In a study linking switching effects to brand positioning, Blattberg and Wisniewski (1989) found that sales promotions for high-quality brands may draw customers of low-quality brands but not in the reverse.

1.6. Purchase acceleration, stockpiling and increased consumption

A number of studies confirm the effects of sales promotions on purchase acceleration both in *timing* (consumers reduce the time between purchases) and *quantity* (consumers purchase larger quantities) (Blattberg and Levin, 1987; Seetharaman and Chintagunta, 2003). While a decline in demand immediately following a sales promotion might be an expected outcome, early researchers did not observe this effect (Abraham and Lodish, 1993; Blattberg and Neslin, 1989). However, subsequent studies, grounded in more robust time series analysis and larger samples demonstrate both pre-and post changes in demand patterns (Macé and Neslin, 2004; Van Heerde et al., 2001). These findings are interesting in that they provide evidence of consumer learning through anticipation of sales promotions (Erdem et al., 2003; Sun et al., 2003). Remarkably, these shifts in purchase timing may also lead to significant increases in overall consumption (Chan et al., 2008; Sun, 2005).

1.7. Customer behavior in response to sales promotions

To employ price reductions effectively, brand managers must understand the relationship between pricing decisions and consumer behavior. Consequently, previous empricial research has examined this topic. This research concludes that customers may be segmented according to their likely response to a sales promotion. A number of studies identify 'deal-prone' customers who are considered to be particularly responsive to promotions (Bawa and Shoemaker, 1987; Gauri et al., 2008; Teel et al., 1980; Webster, 1965). Studies have shown that this segment correlates to specific demographic characteristics (Blattgerg et al., 1978) and psychographic traits (Ailawadi et al., 2001). Schneider and Currim (1991) further distinguish deal proneness between *active* and *passive* customers based on a study of coupons and in-store displays, where coupons require greater engagement for customers than in-store promotions. This distinction is extended by Ailawadi and Neslin (1998) and Bell et al. (2011) who contrast 'out of store' behavior, i.e. checking catalogues and advertising, and 'in-store' actions where customers seek promotions during the shopping experience. In-store actions may be either 'planned' or 'unplanned' with unplanned experiences resulting in greater processing of in-store information and increasing the influence of in-store promotions (Bucklin et al., 1998). Reinforcing differences in segmentation behavior and shopping approaches, Park et al. (1989), estimate that planned and unplanned purchases account for a similar proportion of sales during a regular weekly shopping experience. Consumer behavior is also associated with shopping frequency and store choice. For example, shoppers in one type of supermarket may prefer a small discount with a future bonus for loyalty compared with another store that offers an immediate and substantial benefit.

Consumer learning is impacted by managers' sales promotion decisions concerning the level of price cuts, frequency and the consistency between regular prices and discounts. Grounded in past shopping experiences, customers form a reference price for both regular and promotion prices (Lattin and Bucklin, 1989; Monroe, 1973). Exposure to frequent price reductions lowers the reference price of a brand making the higher, regular price seem less attractive (Lattin and Bucklin, 1989). Furthermore, constant exposure to promotions may result in customers becoming increasingly deal sensitive which may diminish their long-term effectiveness (Jedidi et al., 1999).

This review does not attempt to be exhaustive, however a number of conclusions may be drawn. First, the sales bump arising from a sales promotion is usually immediate and considerable but its magnitude may vary depending on the product category and store type. Second, sales bump effects are generally explained by learned behavior theory allowing customers to be segmented based on their attitudes and behavior towards sales promotions. Finally, although new demand may come from category expansion or attracting brand switchers, the majority of sales can be attributed to current customers resulting in cannibalization effects when they switch to the sales promotion. Today, we know very little about cannibalization effects for supermarket products. Consequently, without a deeper understanding of cannibalization, the sales promotion literature remains incomplete. Such an investigation is highly relevant to both researchers and managers looking to fully understand the financial implications of a sales promotion. To address this knowledge gap, the objectives of this study are:

a. to develop a predictive model of the expected dynamic effects of sales promotions; and
b. to determine cannibalization effects of common price reductions (10% and 15%) across three store sizes/types (large, medium and small supermarkets).

2. Methodology

To address our research objectives, the study draws on two data sources — national supermarket scan data and a manufacture's sales promotion schedules for a nationally distributed product — employing a structural vector autoregressive modeling approach. Scan data covered more than 500,000 unit-monthly sales over three years, across multiple chains, and incorporating 219 large, 1449 medium and 947 small supermarkets. We use the following criteria to classify the stores based on size. Large stores equate to hypermarkets. These typically carry 100,000–200,000 SKUs and combine groceries with big-ticket items such as appliances. Their business model is based on high volume and low-margin sales. Medium size stores are regular supermarkets that carry between 30,000 – 50,000 different products. Small supermarkets, sometimes known as convenience stores carry around 2,000 products. They charge higher prices than larger supermarkets which they can justify due to longer trading hours, shorter queues and convenient location. Following the recommendation of Chan et al. (2008), we rely on unit sales data rather than elasticity decomposition.[1] Only data covering the simultaenous offering of the two products (promotion and non-promotion) were included in the analysis. Although manufacturers can choose amongst a variety of sales promotion options, price promotions remain one of the most common (Srinivasan et al., 2002).

2.1. Econometric modeling

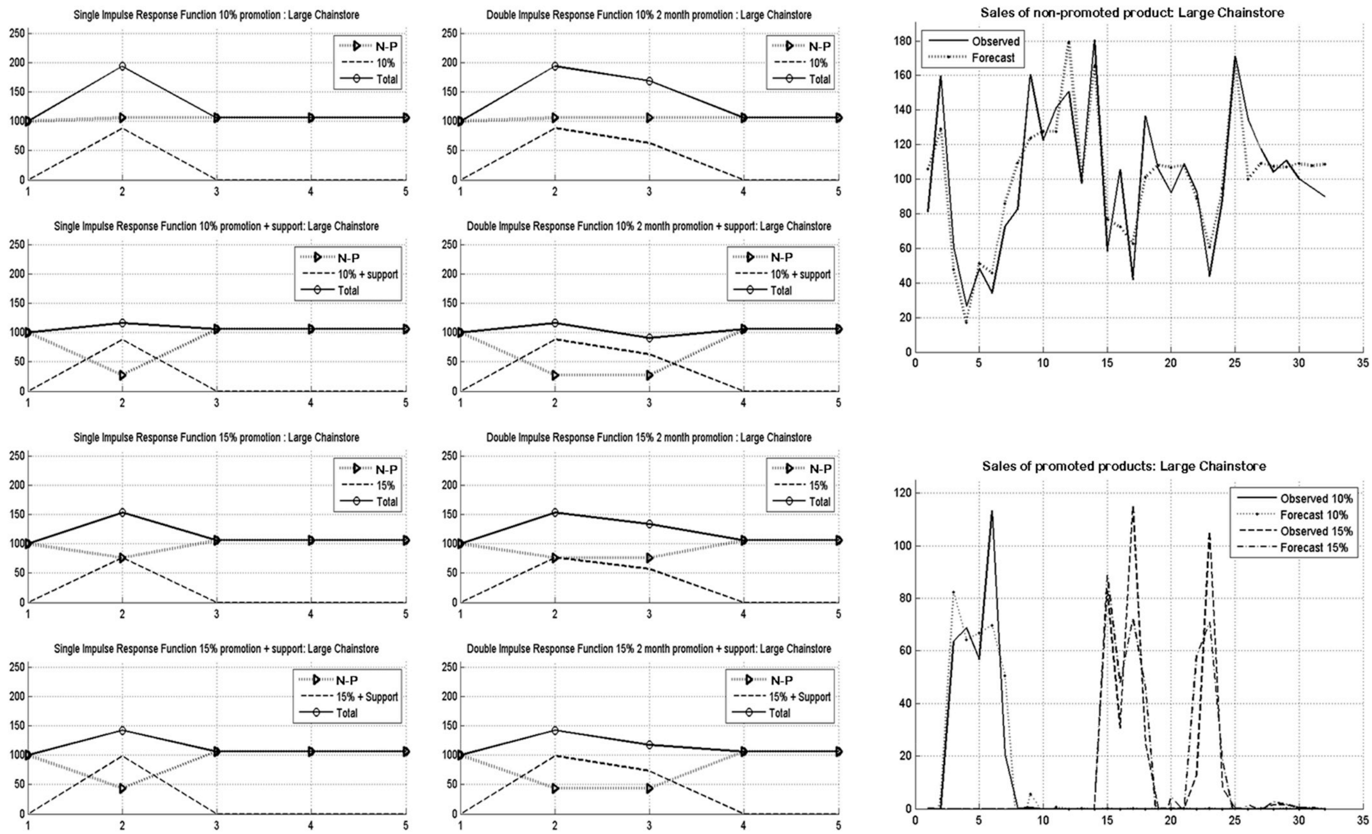
In the present study, analysis was based on the following endogenous variables: monthly sales of the non-promoted product (S_{Base}), sales of promoted products at 10% ($S_{10\%}$) and 15% discount levels ($S_{15\%}$). Three types of exogenous variables were retained:

i. number of stores in which the non-promoted product and promotion were each present ($N_{Base,}$ $N_{10\%}$, $N_{15\%}$).
ii. standardized duration of the promotions of the promoted product (P_{Base}).
iii. standardized duration of advertising support for the promotion ($P_{10\%}$ and $P_{15\%}$).

Fig. 1a, b and 1c show the observed and predicted sales of the non-promoted product in conjunction with the promotions across store-chains. Table 1 reports estimates of the impact on sales and details of estimated parameters coefficents, (c_{ij}), for exogenous variables (P_{Base}, $P_{10\%}$ and $P_{15\%}$), as well as the one month lag autocorrelations, (a_{ij}), for the endogenous variables (S_{Base}, $S_{10\%}$ and $S_{15\%}$).

Using the standard approach based on Fischer's information matrix (Hamilton et al., 1994), none of the structural coefficients of the A_0 matrix were found to be statistically significant for any of the stores under an AB type model. This supports the assumption that the model is well specified and free of any simultaneity effect. We found statistically significant values for the diagonal elements of B_0 for all three types of supermarkets and identified that the covariance matrix of the structural

[1] Unit-based decomposition is considered to reflect stolen business, while elasticity decomposition measures the relative influence of changes in consumers' decisions on the increase in own-good demand (Steenburgh, 2007).



a)

Fig. 1. a) Large Chainstore, b) Medium Chainstore, c) Small Chainstore.

model is close to a diagonal form supporting the B type model structure.[2] Datasets were standardized by setting the average non-promoted sales to 100 and analysed separately. To investigate contemporenaous and lagged effects of the simultaneous presence of the same brand at different prices and places in the same store, a general AB type SVARMAX(1,1) model was adopted in the following form (Greene, 2012).

$$\mathbf{Y}_t = \mathbf{A}_1\mathbf{Y}_{t-1} + \mathbf{C}\mathbf{X}_t + \mathbf{A}_0^{-1}\mathbf{B}_0\varepsilon_t \tag{1}$$

The coefficients of the exogenous variables and the auto-correlation coefficients were estimated from the reduced form equations. The structural coefficients of the model were then estimated from the reduced form innovation matrix (reduced model residuals) by minimizing concentrated log-likelihood function.

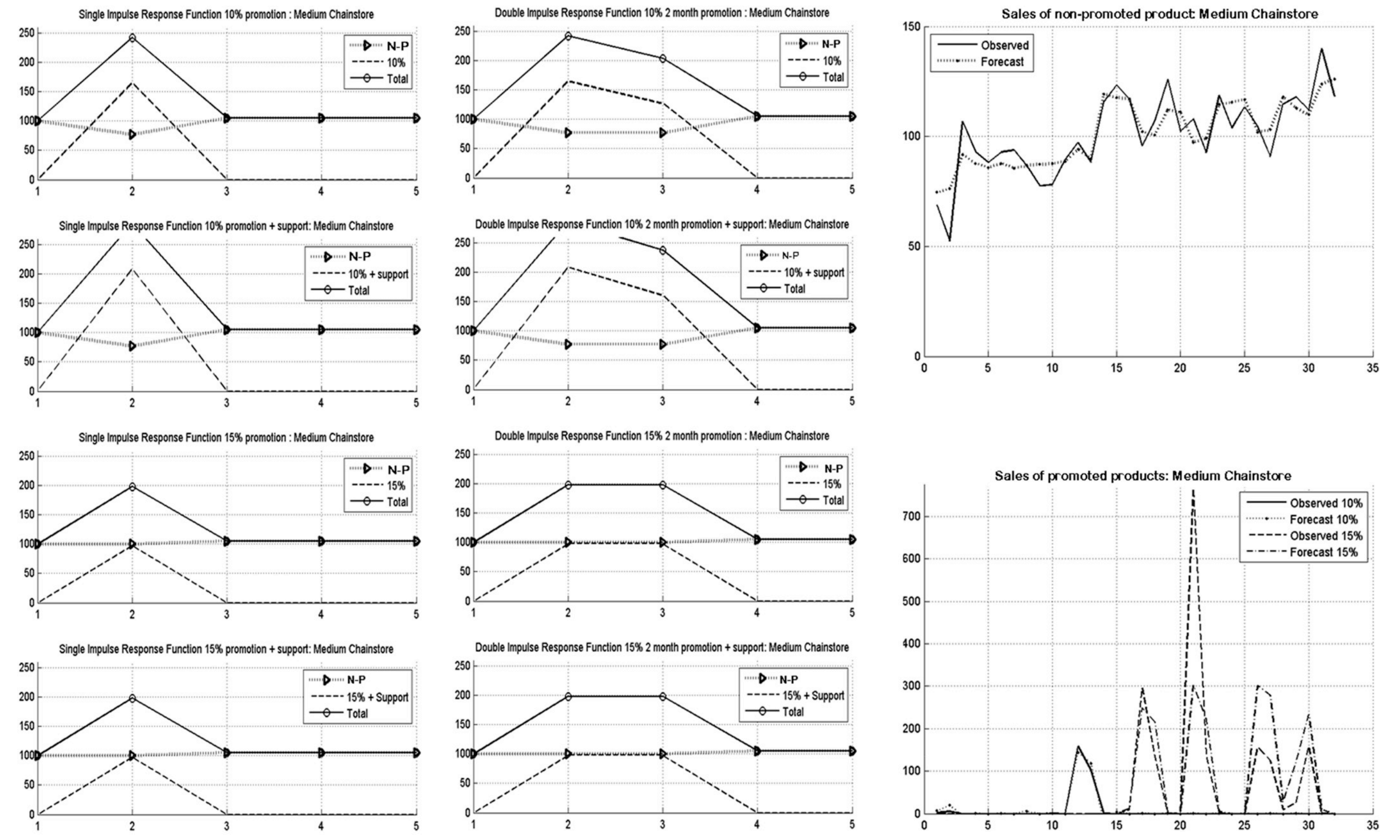
The augmented Dickey–Fuller test (ADF) was conducted on the non-promoted product sales time series for different time lags around the value of $\sqrt{T} = \sqrt{36}$ to test for various forms of stationarity as suggested by Kwiatkowski et al. (1992). Trend non stationarity was observed for the B data set and removed using differencing. Other detrending methods, including smoothing quadratic splines gave very similar results but are not reported here. The optimal time lag was found to be one for all three datasets. Optimal values of p and q were chosen based on the Akaike (AIC) model performance criteria. The possible choices parameter sets were also compared by checking the relative degree of diagonalization of the component covariance matrices of the strucural forms of the models. The number of potential parameters of the reduced form model was 27. The number of active parameters was subsequently reduced to 7, 8 and 11 for small, medium and large stores using backward as well as mixed selection. With three endogenous variables, the minimum number of restrictions necessary for the identification of the $\mathbf{A_0}$ and $\mathbf{B_0}$ matrices with 3 endogenous variables is 12. Hence, the maximum number of structural parameters that could be estimated was 6 from a choice set of 18. Although most possible permutations were investigated, we will only report the most plausible set of hypotheses.

In this most plausible model (AB type) it was assumed that the sales of promoted goods had an impact on the sales of non-promoted products, i.e. there are simultaneity effects. This corresponds to the lower triangle hypothesis suggested by Lutkepohl (2006) with the added constraint that 10% and 15% promotions did not co-exist (as observed in the data). The moving average coefficient matrix $\mathbf{B_0}$ was assumed to be diagonal. This led to the parameter set $\boldsymbol{\theta} = \{A_{21}\ A_{31},\ B_{11},\ B_{22},\ B_{33}\}$ with all diagonal elements of **A** set equal to 1 (see equation (1)). The IRF was calculated for a 5 month period for all three store types and durations of one and two months (see Fig. 1a,b,c).

2.2. Findings

Results show strong evidence of an overall sales bump following sales promotions (Table 1c). When a temporary price cut was introduced (i.e. while the non-promoted product remains at regular price), the largest combined sales were recorded in medium sized supermarkets at 286% for a 10% discount (186% bump) and 198% for 15% (98% bump). For small stores, combined post-promotion sales were 197% at 10% (97% bump) and 168% at 15% (68% bump). Across large supermarkets overall sales were 116% at 10% discount (16% bump) and 142% (42% bump) for a 15% price reduction. Table 1d also shows the estimated autocorrelations for endogenous variables (S_{Base}, $S_{10\%}$ and $S_{15\%}$) for a one month time lag where we observe no significant knock-on effect for

[2] Results are not reported due to space constraints.



b)

Fig. 1. (*continued*).

sales of the non-promoted product (a_{11}). This also shows a significant decrease of between 23% and 25% in the sales level for the second month compared with the first, when promotions run for two consecutive months.

The impulse response functions show that cannibalization effects (a decline in sales for the non-promoted product) were greatest in large supermarkets where sales of the non-promoted product declined by 78% at the 10% price cut and 62% at 15%. In medium size stores, introducing a promotion product involving a temporary price cut of 10% resulted in cannibalization of the non-promoted product 28%. No significant cannibalization effects were observed in small stores (c_{12}, c_{13}). Advertising support associated with the price cuts also contribute to cannibilization effects especially in large stores (see Table 1a), while additional support has little effect on small and medium sized stores.

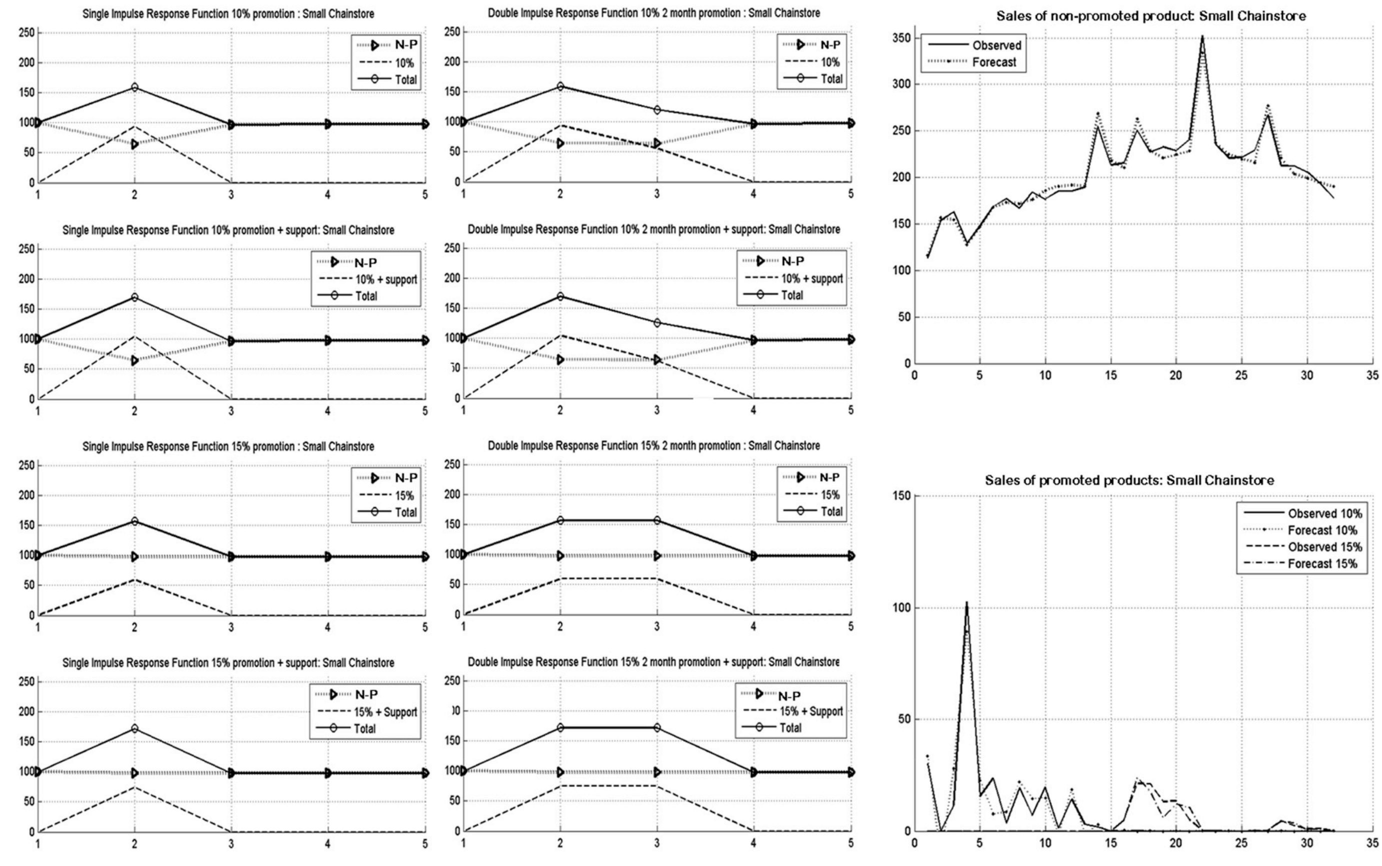
3. Discussion

French supermarkets provide a unique opportunity to investigate cannibalization effects as typically the non-promoted product remains in store during a sales promotion. Consequently, using a structural vector autoregressive approach, we analysed sales bump and cannibalization effects following the introduction of a sales promotion consisting of a temporary price cut of either 10% or 15% for the same brand. As anticipated from the earlier literature review, results show evidence of a strong and immediate sales bump of between 16% and 186% following a sales promotion.

Sales bumps effects are in line with previous studies such as Bijmolt et al. (2005) who found that a 20% price reduction led to a 73% rise in sales, and Bell et al. (2011) who recorded a sales bumps of 2.1–4 times regular sales in hypermarkets. Interestingly, the considerably larger bump effects in large supermarkets for a 15% price reduction (42% sales growth) versus 10% (16% growth), suggests that the 10% reduction is inadequate to motivate customers. These findings might be explained by a couple of factors. Although shopping at large supermarkets encourages 'deal-prone' behavior (Bawa and Shoemaker, 1987; Gauri et al., 2008), sales promotions compete against promotions in other categories impacting customers' perceptions of the discounted reference price. A price cut of 10% is likely to be perceived at the low end of the discount continuum and therefore not large enough to encourage brand switching. However, this appears not to be the case at the 15% temporary price reduction.

On the other hand, the higher sales bump recorded in medium size supermarkets and small stores, at the 10% price cut suggests that this level of reduction is more interesting in these stores. The findings may also reflect challenges facing brand managers and retailers in large supermarkets (irrespective of the size of a price cut) to generate awareness of a sales promotion compared with smaller stores. Finally, regarding sales bump effects, we demonstrate a significant decline in the bump of around 25% in the second month when promotions continue over two consecutive months. Although not the focus of this study, these findings support prior research such as Jedidi et al. (1999) and Ataman et al. (2010), demonstrating wear-off effects of extended sales promotions with the potential to influence the perceived reference price. We also found that supporting price cuts with additional advertising, such as through catalogues, impacted both the sales bump and cannibilization effects in large stores.

Our model shows that cannibalization effects of the non-promoted product were substantial in large supermarkets only, for both 10% and 15% discount (78% and 62% respêctively) supporting the notion that these stores attract deal-prone customers or at least encourage deal-seeking behavior. Remarkably, these rates of cannibalization are higher than the 39% observed by Van Heerde et al. (2004), who



c)

Fig. 1. (*continued*).

investigated cannibalization of peanut butter in medium size (regular) supermarkets, suggesting that cannibalization rates may be under-estimated in large stores. However, cannibalization of 28% was recorded in the current study is similar to their findings when we consider lost sales in medium-sized stores at the 10% temporary price cut. Unfortunately, there were insufficient cases to assess effects at the 15% price cut. Furthermore, by applying the findings of Van Heerde et al. (2004) to small supermarkets would give an over-estimation of own-effects, as the current study found no evidence of cannibalization in these stores. A summary of the main findings from both studies is provided in Table 2. We explain this finding by positing that shopping behavior in smaller supermarkets is more focused around planned purchases than unplanned, especially for brand loyal customers. Consequently, brand loyal customers are less responsive to temporary price cuts in these stores.

4. Conclusions

4.1. Contributions to theory

To date, research in cannibalization has largely focused on the longer-term effects arising from product and brand extensions, however investigations into cannibalization effects concerning a temporary product introduction, as in the case of a sales promotion is negligible. The current study develops a predictive model of the expected dynamic effects of a common sales promotion and estimates cannibalization effects across different types of supermarkets for a common grocery item. Consequently, this study makes a number of contributions to the sales promotion and cannibalization literatures. First, our study extends prior research into sales bump effects by investigating a different product category (french pound cake). By modeling sales bump effects and across different supermarket types we demonstrate that the sales bump is significantly higher in small supermarkets compared with large supermarkets with demand growth driven primarily by brand switchers rather than regular customers. Second, we extend the work of Van Heerde et al. (2004) by estimating cannibalization effects for specific price reductions. In so doing, we conclude that cannibalization may be significantly higher in large supermarkets than previously thought, but over-estimated in small supermarkets. Our econometric model has considerable implications for assessing brand profitability arising from temporary price cuts. Finally, through our analysis of two common price reductions we demonstrate that the magnitude of the price cut has a moderating effect on cannibalization rates. This is particularly evident in large supermarkets where a 15% temporary discount attracts additional brand switchers compared with a 10% cut.

4.2. Managerial implications

Our study has a number of implications for management practice. First, managers should understand the potential for cannibalization effects to impact the financial success of a sales promotion. When cannibalization is high compared with secondary effects (brand switching), manufacturer's margins are reduced. Unfortunately, in the current study we did not have access to the manufacturer's revenue or cost data to evaluate the profit impact from their promotions. However, integrating this information into our model could easily be undertaken by a brand manager. Second, the level of price cut is important to consider when planning sales promotions. We show how a relatively small price discount can have a large impact on customer behavior while the same price cut can have different effects depending on store type.

Table 1
Estimated parameters.

Table 1a: Estimated Values of Coefficients in C and Autocorrelations A1

(c_{ij}) coefficient	Exo. Variable	Endo. Variable	Small Coef	Small Std E	Small t val	Small P	Medium Coef	Medium Std E	Medium t val	Medium P	Large Coef	Large Std E	Large t val	Large P
Presence of different products			Estimated coefficients of the exogenous variables linked to presence (columns 1,2 and 3 of C)											
c_{11}	N_{Base}	S_{Base}	**0.94**	0.02	42.58	0.00	**1.05**	0.02	58,80	0.00	**1.06**	0.05	21.13	0.00
c_{12}	$N_{10\%}$	S_{Base}	NS				**-0.28**	0.07	-3,72	0.00	NS			
c_{13}	$N_{15\%}$	S_{Base}	NS				**-0.05**	0.01	-3,64	0.00	**-0.29**	0.11	-2.57	0.02
c_{21}	N_{Base}	$S_{10\%}$	NS				NS				NS			
c_{22}	$N_{10\%}$	$S_{10\%}$	**0.92**	0.05	19.76	0.00	**1.65**	0.07	22.28	0,00	**0.88**	0.07	12,37	0.00
c_{23}	$N_{15\%}$	$S_{10\%}$	NS				NS				NS			
c_{13}	N_{Base}	$S_{15\%}$	NS				NS				NS			
c_{23}	$N_{10\%}$	$S_{15\%}$	NS				NS				NS			
c_{33}	$N_{15\%}$	$S_{15\%}$	**0.59**	0.06	10.24	0.00	**0.97**	0.13	7.30	0.00	**0.77**	0.08	9.53	0.00
Advertising support of product			Estimated coefficients of the exogenous variables linked to advertising support (columns 4,5 and 6 of **C)**											
c_{14}	P_{Base}	S_{Base}	**0.60**	0,06	10,00	0.00	NS				**0.31**	0.05	5,64	0.00
c_{15}	$P_{10\%}$	S_{Base}	NS				NS				**-0.78**	0.16	-4.85	0.00
c_{16}	$P_{15\%}$	S_{Base}	NS				NS				**-0.33**	0.16	-2.05	0.05
c_{24}	P_{Base}	$S_{10\%}$	NS				NS				NS			
c_{25}	$P_{10\%}$	$S_{10\%}$	**0.111**	0.03	3,24	0.00	**0,44**	0,12	3.68	0.00	NS			
c_{26}	$P_{15\%}$	$S_{10\%}$	NS				NS				NS			
c_{34}	P_{Base}	$S_{15\%}$	NS				NS				NS			
c_{35}	$P_{10\%}$	$S_{15\%}$	NS				NS				NS			
c_{36}	$P_{15\%}$	$S_{15\%}$	**0.152**	0.02	7,25	0.00	NS				**0.22**	0.09	2.29	0.03

Table 1b: Estimated autocorrelation coefficients, A1

(a_{ij}) coefficient	EndogenousVariable	Coef	Std E	t val	P	Coef	Std E	t val	P	Coef	Std E	t val	P
a_{12}	S_{Base}	NS				NS				NS			
a_{22}	$S_{10\%}$	**-0.40**	0.04	10.27	0.00	**-0.23**	0.04	5.59	0.00	**-0.28**	0,09	3.10	0.01
a_{33}	$S_{15\%}$	NS				NS				**-0.25**	0.08	3.09	0.01

Table 1c: Combined sales

Product	over one month	over two months	over one month	over two months	over one month	over two months
10% discount	197%	157%	286%	263%	116%	87%
15% discount	168%	168%	198%	198%	142%	117%

Table 1d: Estimated coefficients of structural matrix A_0 and moving average matrix B_0 (AB type model: H_{ab})

Endogenous Variables & error terms		Coef	Std E	t val	P	Coef	Std E	t val	P	Coef	Std E	t val	P
S_{Base}	10% Sales (A_{21})	0.05	3.98	-0.04	0.97	-0.31	21.22	-0.01	0.99	0.03	0.07	0.04	0.71
S_{Base}	15% Sales (A_{31})	-0.02	3.98	0.35	0.73	-2.26	1.07	-2.11	0.05	0.12	0.09	0.14	0.20
S_{Base}	ε Base Sales (B_{11})	**-11.90**	3.98	6.63	0.00	**8.67**	1.07	8.12	0,00	**16.97**	2.09	8.12	0.00
$S_{10\%}$	ε 10% Sales (B_{12})	**4.43**	0.55	-8.12	0.00	**1294.6**	184.00	7.04	0.00	**8.80**	1.25	7.04	0.00
$S_{15\%}$	ε 15% Sales (B_{13})	**-1.82**	0.23	-8.12	0.00	**65.38**	9.29	7.04	0.00	**10.70**	1.51	7.04	0.00

Table 2
Summary of results – sales bump and cannibalization effects.

	Large stores	Medium stores	Small stores	Van Heerde et al. (2004)
Combined sales - 10% price cut	116%	286%	197%	
cannibalization	78%	28%	NIL	
Combined sales - 15% price cut	142%	198%	168%	
cannibalization	62%	NA	NIL	
cannibalization - price cuts above 5%				28%

Consequently, understanding the potential cannibalizing effects of various promotions and across different types of supermarkets would assist managers, not only in understanding the financial consequences of various sales promotions, but would strenghthen their negotiating position with retail buyers.

4.3. Limitations and future research

Despite the contributions from this study, as with all empirical research there are limitations that may limit generalizing the findings. One limitation of this study is that it relied on one brand although single product studies dominate this literature. One explanation for this may be due to the considerable effort required to validate commencement and expiration dates of a manufacturer's sales promotions. This process was complicated in the current study, particularly when multiple sales promotions were operating concurrently across different chains, and for the same brand. Supply disruptions can also delay scheduled promotions. Secondly, sales promotions are not conducted in a vacuum so competitors' actions may influence the effectiveness of a sales promotion. We did not integrate this dimension in the current study as we are unaware as to whether this data exists in a consolidated form.

Notwithstanding these challenges, future research might examine cannibalization effects across different supermarkets for other product categories and for sales promotions other than temporary price cuts. While this study involved extensive use of secondary data over multifarious regions and time periods and a rigorous implementation of a standard structural VAR method, we acknowledge that Randomized Control Trial (RCT) or a laboratory experiment might also be considered in future research. Two findings considered outside the scope of this investigation also warrant further investigation in the context of limited prior research. The first concerns the 'wear-off' effect of sales promotions that remain in place for extended periods. Understanding the optimal length of a sales promotion remains a challenge for brand managers. A second avenue for future research concerns understanding sales bump and cannibilization effects when temporary price cuts are supported with additional advertising such as catalogues. Although work has begun in this area (see Gupta, 1988; Narasimhan et al., 1996; Van Heerde et al., 2004), more research is needed as innovative sales promotion tools are created. In conclusion, brand managers would be in a stronger position during trade negotiations if they have a sound understanding of the financial implications following sales promotions. In that context, estimating cannibalization effects is crucial.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jretconser.2019.101982.

Appendix 1. Photograph of a typical french pound cake

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